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Review

Role of antiseptics in the prevention and treatment of infections in nursing homes

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SUMMARY

Inadequate infection control, wound care, and oral hygiene protocols in nursing homes pose challenges to residents' quality of life. Based on the outcomes from a focus group meeting and a literature search, this narrative review evaluates the current and potential roles of antiseptics within nursing home infection management procedures. We examine contemporary strategies and concerns within the management of meticillin-resistant *Staphylococcus aureus* (MRSA; including decolonization regimes), chronic wound care, and oral hygiene, and review the available data for the use of antiseptics, with a focus on povidone-iodine. Compared with chlorhexidine, polyhexanide, and silver, povidone-iodine has a broader spectrum of antimicrobial activity, with rapid and potent activity against MRSA and other microbes found in chronic wounds, including biofilms. As no reports of bacterial resistance or cross-resistance following exposure to povidone-iodine exist, it may be preferable for MRSA decolonization compared with mupirocin and chlorhexidine, which can lead to resistant MRSA strains. Povidone-iodine oral products have greater efficacy against oral pathogens compared with other antiseptics such as chlorhexidine mouthwash, highlighting the clinical benefit of povidone-iodine in oral care. Additionally, povidone-iodine-based products, including mouthwash, have demonstrated rapid in-vitro virucidal activity against SARS-CoV-2 and may help reduce its transmission if incorporated into nursing home coronavirus 2019 control protocols. Importantly, povidone-iodine activity is not adversely affected by organic material, such as that found in chronic wounds and the oral cavity. Povidone-iodine is a promising antiseptic agent for the management of infections in the nursing home setting, including MRSA decolonization procedures, chronic wound management, and oral care.

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Introduction

Nursing homes are an important component of the health service network for the elderly population. However, these facilities provide an ideal environment for the introduction and transmission of infections due to the sharing of air, water, food, and healthcare in a crowded setting [1]. Data from a European study conducted in 26 countries indicated the prevalence of long-term care facility residents with at least one healthcare-associated infection was 3.7% (range: 0.9—8.5%) [2]. Many nursing home residents are frail, exposed to multiple medications, and often have underlying chronic diseases, functional dependency, and cognitive impairments [1,3—5]. These factors, with other cultural and social factors, make older adults more susceptible to infections than younger populations, with significant negative impact on morbidity and functional decline [6].

Infection outbreaks in nursing homes are common, underscoring the need for active infection control programmes in these facilities [1]. Evidence accrued during the recent COVID-19 pandemic demonstrated factors contributing to increased risk for nursing home epidemics, highlighting the urgent need for adequate healthcare plans for elderly residents [7]. During the first wave of the pandemic, nursing home residents suffered a substantial proportion of all deaths due to COVID-19 [8]. Furthermore, investigations have shown a four-fold difference in infection control in acute care hospitals compared with nursing homes [9]. In infection outbreak models, the presence of nursing homes substantially potentiated the effect of nosocomial outbreaks on other hospitals, leading to an average 46.2% relative increase in outbreak impact compared with inclusion of hospitals alone [10].

Nosocomial infections and multidrug-resistant organisms (MDROs) are significant issues for nursing homes globally [11]. Between 1.6 and 3 million infections occur in nursing homes in the USA each year and more than one-third of US nursing home residents harbour MDROs [12]. Similarly, it has been calculated that the percentage of antimicrobial-resistant bacterial isolates (as a proportion of the number of isolates tested) in Europe is 28.0% among long-term care facility residents across 11 countries [2]. Nursing home residents are disproportionately affected by morbidity and mortality from MDROs, most commonly meticillin-resistant *Staphylococcus aureus* (MRSA) [9,13,14]. Infections in these facilities and the resultant use of antibiotics are key reasons for the emergence of antibiotic-resistant organisms such as MRSA [15,16]. In a 2016 survey of French nursing homes, 2.76% of residents were treated with antibiotics; prophylactic treatment was used in 13.7% of cases, and antibiotic treatment duration exceeded seven days in over a third of cases [17].

A focus meeting, attended by all authors, on 'antiseptics in the management of infections in the nursing home setting' was held in December 2020. The discussions resulting from that meeting, including the literature selected and reviewed by the authors, and additional publications identified through subsequent literature searches, form the basis of this narrative review. The aim of this article is to examine available information on (i) MRSA management, including decolonization procedures, (ii) chronic wound management, and (iii) oral care in nursing homes. For each of these points we review current practice, limitations, and concerns, and evaluate the role of antiseptics, in particular povidone-iodine (PVP—I), for the management of infections in the nursing home setting.

Methods

This narrative review was guided using information derived from the focus meeting (December 2020) and a subsequent search of the PubMed database (January 2021). This was not a systematic review, nor was it intended to be exhaustive; instead, we hoped to gain an understanding of current practice in nursing homes, investigate the resulting limitations and challenges, and identify whether the use of PVP-I might permit improvements in infection control.

For the literature review, search terms were chosen based on discussions during the focus meeting. No date restrictions were included in the searches. Various combinations of the following key terms were used for the literature searches: 'nursing home'; 'povidone-iodine (PVP—I)'; 'chlorhexidine (CHG)'; 'polyhexanide (PHMB)'; 'silver'; 'meticillin-resistant *Staphylococcus aureus*'; 'mupirocin'; 'decolonization'; 'chronic wounds'; 'infection'; 'biofilm'; 'resistance'; 'oral care'; 'periodontitis'; 'severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)'. Synonyms of each term were included in all searches. Based on their abstracts, only papers that were considered directly relevant to the three focus areas (MRSA, chronic wounds, and oral care) were included in this review article. Further papers of interest were also identified from reference lists within the papers in the searches.

Results

Focus area 1: MRSA management in nursing homes

MRSA is a key cause of skin and soft tissue infection (SSTI) in nursing homes [18]. The incidence of SSTIs has risen with a rapid increase in MRSA infections [19,20]; in a Belgian national study of nursing homes, 17.5% of residents with infections had skin infections [21]. Among nursing home residents, the presence of chronic skin diseases or indwelling devices is a risk factor for colonization of MRSA [22,23].

The high prevalence of SSTIs and MRSA infections among residents highlights the need to prevent the spread of MRSA in nursing homes [9,24,25]. Eradication of MRSA is theoretically possible through elimination of MRSA-positive nursing home admissions over several years [14]; however, this is unlikely to be achieved in practice, in part because there is currently no consensus for MRSA screening at nursing home admission. Movement of residents and physicians between hospitals and nursing homes may facilitate MRSA spread within the nursing home environment [26,27], and admission of MRSA-colonized residents can cause outbreaks without strict infection control protocols [28].

Role of decolonization

Decolonization, the goal of which is to decrease or eliminate bacterial load on the body, is an integral strategy used to control and prevent the spread of MRSA [29]. Decolonization may reduce strain-specific prevalence of MRSA [14], and decolonization of MRSA carriers in the intensive care unit has been shown to provide downstream benefits [30]. However,

Table I
Role of antiseptics and their features in infection control in the nursing home

Procedure in nursing home	Role of antiseptics	Essential features of antiseptic used in procedure	Commonly used antimicrobial agent			
			PVP-I	CHG		Mupirocin
MRSA decolonization	Intranasal application of antiseptic and antiseptic bodywash to eradicate MRSA colonization To be performed when known MRSA carriers enter the nursing home and when a nursing home resident tests positive for MRSA	Activity against MRSA	✓ [62]	✓ [34,35,37,38]		✓ [34–38]
		No development of bacterial resistance or cross-resistance	✓ [60]			
		Activity against antibiotic- and antiseptic-resistant strains of MRSA	✓ [57–60]			
			PVP-I	CHG	Silver	PHMB
Chronic wound care	Antiseptics to be used: – to cleanse wounds presenting with signs and symptoms of infection (critical colonization or local infection), and in patients with a history of recurrent wound infections – on wounds that may harbour a biofilm – on wounds with excessive exudate, debris, or necrotic tissue in the wound bed – as an adjunct to systemic antibiotics in patients who have signs of spreading wound infection	Rapid antimicrobial activity	✓ [64,79,87,105]	✓ [79,87,105]		
		Broad spectrum of antimicrobial activity	✓ [64,81,82,87,104]	< PVP-I [104]	< PVP-I [64,104]	< PVP-I [64,104]
		No development of bacterial resistance or cross-resistance	✓ [60]			
		Effective in the presence of organic material (e.g. blood)	✓ [88,104,108,110]	< PVP-I [88,108]	< PVP-I [88,108]	< PVP-I [88,108]
			PVP-I		CHG	
Oral care	Antiseptics to be used: – in a mouthwash product as an adjunct to toothbrushing and professional oral care for the maintenance of good oral health – for the cleaning of oral prostheses such as dentures or implants	Broad spectrum of antimicrobial activity against oral pathogens	✓ [132]		< PVP-I [132]	
		No development of bacterial resistance or cross-resistance	✓ [60]			
		Reduces risk of periodontal disease	✓ [130,131]		✓ [129]	
		Leaves oral tissue and prostheses unstained	✓ [140,141]			
		Effective in the presence of organic material (e.g. blood)	✓ [88,104,108,110]		< PVP-I [88,104,108,110]	

CHG, chlorhexidine; MRSA, meticillin-resistant *Staphylococcus aureus*; PHMB, polyhexanide; PVP-I, povidone-iodine.
< PVP-I, less effective than PVP-I.

broader use of decolonization beyond the intensive care unit would be required to contribute to country-wide eradication efforts [30].

In a survey of 13 nursing homes, MRSA carriage was associated with denial of admission [31]; decolonization may remove this barrier. However, across many regions, systematic screening for MRSA colonization and subsequent decolonization is not required at nursing home admission; this is a possible avenue for further research.

Current decolonization strategies and limitations

Decolonization of MRSA commonly involves use of an intranasal antimicrobial agent, plus an antiseptic body wash to eliminate bacteria from other body sites [29,32]. Elimination of nasal carriage of *S. aureus* is particularly important to prevent systemic infections [33]. Several studies have shown success in reducing MRSA colonization in nursing homes with intranasal mupirocin 2% ointment applied to the anterior nares twice daily for 5 days and CHG body wash [34—38].

However, previous decolonization strategies in nursing homes have failed due to factors such as development of resistance and reacquisition of MRSA [39,40]. Mupirocin resistance was reported in 3.8% of MRSA isolates in 2002 [41], and 12% of isolates in 2013 [42]. Resistance may also be transferred from strains of other bacterial species during mupirocin prophylaxis [43] or decolonization procedures [36,44]. In many nursing homes, the prevalence of mupirocin-resistant strains of MRSA increased between 2006 and 2009 [45], supporting an increase in the rate of mupirocin resistance [46,47]. Persistence of nasal mupirocin-resistant MRSA after decolonization reflects a failure in infection control [48]; hence, extended mupirocin use should be avoided in MRSA-endemic settings [49].

The potential role of antiseptics in MRSA decolonization

Due to the concern of mupirocin-resistance, antiseptics such as CHG and PVP-I have been recommended for evaluation in decolonization protocols [46]. The ideal antiseptic for MRSA decolonization is highly effective against MRSA, including antibiotic- and antiseptic-resistant strains, and does not induce resistance or cross-resistance (Table I) [29].

Several studies have shown that use of CHG can lead to resistance in MRSA and other bacterial species [50—54]. CHG exposure may also result in cross-resistance to antibiotics such as daptomycin, ceftazidime, tetracycline, and colistin [54—56].

PVP-I has shown superior bactericidal activity against MRSA versus CHG and mupirocin, and is active against both CHG-resistant and mupirocin-resistant MRSA strains [57—60]. Compared with nasal mupirocin, PVP-I had similar efficacy in reducing surgical site infections in patients undergoing orthopaedic surgery [60,61]. Moreover, single nasal applications of 10% PVP-I significantly reduced nasal MRSA 1 and 6 h after application [62]. Importantly, no reports have observed links between PVP-I and induction of bacterial resistance or cross-resistance to antiseptics or antibiotics [60]. In practice, nasal PVP-I swabbing has shown clinical success and cost savings when used as an alternative to MRSA screening for preoperative patients [63].

Focus area 1: summary and recommendations

As outlined in Table I, we recommend decolonization of known MRSA carriers when entering nursing homes, and of current residents should they test positive for MRSA. Whilst current evidence suggests PVP-I may be an ideal antiseptic for short-term decolonization, further evidence is needed to understand the use of PVP-I for long-term decolonization. Additional research in this area is clearly indicated: widespread application of PVP-I or other antiseptics within decolonization regimes may provide much-needed avenues for MRSA infection control within nursing homes.

Focus area 2: chronic wound management in nursing homes

Chronic, non-healing wounds include vascular leg ulcers, diabetic foot ulcers, and pressure ulcers [64]. As wound healing slows with age, elderly nursing home residents constitute the age group most susceptible to development of chronic wounds [65] and a subsequent decline in quality of life [66]. Nursing home residents are especially at risk of developing pressure injuries that progress into an open wound; in European studies of nursing homes, pressure ulcers comprised 46—50.5% of all chronic wounds [67,68]. Open wounds may subsequently become colonized with bacteria [69], causing additional complications.

MRSA is estimated to be present in 7—30% of chronic wounds, and may enter the bloodstream causing severe illness [70]. One of the most important factors affecting chronic wound healing is the presence of a biofilm, which can cause chronic wounds to be locked in an inflammatory state and may increase the likelihood of infection [64]. In one analysis, 60% of chronic wounds had a biofilm versus 6% of acute wounds [71]. Mature biofilms in chronic wounds exhibit an enhanced tolerance to many antimicrobial agents, including antibiotics and antiseptics [64,72,73].

Current recommendations for treatment of chronic wounds in nursing homes

In order to minimize antibiotic resistance, systemic antibiotics are not recommended for treatment of chronic wounds [74]. However, a combination of systemic antibiotics and topical antiseptics is recommended in cases of systemic infections, such as sepsis [75]. Antiseptics are preferable to topical antibiotics for treating chronic wounds due to their lower risk of developing bacterial resistance [74,75].

Antiseptics should be used to cleanse infected wounds, and on wounds harbouring a biofilm and/or with excessive exudate, debris, or necrotic tissue in the wound bed (Table I). Recommendations for biofilm treatment describe a window of opportunity following initial wound debridement, where the biofilm is susceptible to effective treatment, specifically antiseptics [64,76]. In a retrospective study of 154,644 patients, increased frequency of debridement was significantly associated with improved healing outcomes in chronic wounds, supporting the use of this 'treatment window' [77].

In nursing homes, the antiseptic of choice for chronic wounds should: possess rapid and broad-spectrum antimicrobial activity; not induce bacterial resistance or cross-resistance; have potent antibiofilm efficacy; be effective in the presence of organic material; and promote wound healing (Table I) [64,72,78—103]. Each of these areas is discussed in greater detail below and in Supplementary Table S1.

Antimicrobial activity

PVP-I possesses a broader antimicrobial spectrum than CHG, silver, and PHMB [64,104]. PVP-I and CHG have also

demonstrated rapid antimicrobial activity, whereas silver and PHMB have not [64,79,87,105,106].

Bacterial resistance

There are no reports of bacterial resistance or cross-resistance arising in response to PVP-I exposure [60]. Many data exist on bacterial resistance to CHG and silver, including in species frequently found in chronic wound biofilms, such as *S. aureus*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, and MRSA [64,78,80,86,93]. In addition to the concern of bacterial resistance, cross-resistance to colistin, ceftazidime, sulfamethoxazole, and imipenem has been described for CHG [54,55]. Prolonged exposure of MRSA to PHMB *in vitro* has been associated with reduced susceptibility to PHMB and daptomycin [107].

Activity against biofilms

PVP-I has potent antibiofilm activity across a wide range of bacterial species commonly found in chronic wounds (Supplementary Table S1) [81,82,87]. In an in-vitro assessment of PVP-I, CHG, and PHMB, PVP-I was the only antiseptic to completely eradicate both *S. aureus* and *P. aeruginosa* biofilms at 15 min exposures [79]; whereas CHG was effective in eradicating *S. aureus* biofilms in this study, lower efficacy was observed in a chronic wound biofilm model [79,83]. In a multi-species biofilm including *K. pneumoniae*, *P. aeruginosa*, and *S. aureus*, only *S. aureus* was reduced below detection levels by CHG, indicating limited efficacy in this setting [93]. In a separate in-vitro study, PHMB was found to be as effective as CHG in reducing the total amount of *P. aeruginosa* biofilm in artificial wound fluid [86]. In an in-vitro study of mature, multi-species biofilms, PVP-I, but not silver, significantly reduced the amount of bacteria present [82]; no significant difference was observed between the silver dressing and an unimpregnated control dressing [82], suggesting that the silver concentration in dressings may be inadequate to treat chronic wounds [86]. In a study using a basal perfusion biofilm model, at seven-day exposures, PVP-I was more effective in reducing multi-species biofilms of *P. aeruginosa*, *B. fragilis*, *S. pyogenes*, and MRSA than was PHMB and silver [84]. Both PVP-I and PHMB eradicated *S. pyogenes*, but silver did not [84].

Efficacy in the presence of organic material

For maximum efficacy in treating chronic wounds, it is important for the antiseptic to have limited inactivation by organic material. The efficacy of PVP-I is not adversely affected in the presence of albumin or blood [104,108—110]. However, the antimicrobial activities of CHG, PHMB, and silver are reduced in the presence of organic material, relative to PVP-I [103,108].

Wound healing

PVP-I has demonstrated the ability to promote wound healing in animal studies, clinical studies, and *in vitro* (Supplementary Table S1) [78,86]. In animal studies, PVP-I increased expression of transforming growth factor-β, promoted neovascularization and re-epithelialization, and simulated wound healing in MRSA-infected skin ulcers [78,86]. In clinical studies, PVP-I increased healing rates of chronic leg ulcers and exhibited anti-inflammatory effects [90,91]. CHG has also demonstrated the ability to improve healing of full-thickness skin wounds in rats [95]. In an animal study, PHMB demonstrated favourable effects on angiogenesis, re-epithelialization, and blood flow with slight lymphocyte infiltration [99]. Despite evidence of healing effects, CHG and PHMB may cause irritation and inflammation, respectively, which could impact wound healing [96,100]. Silver dressings inhibited re-epithelialization of wounds in both animal and in-vitro models [102].

Focus area 2: summary and recommendations

A recent algorithm for the treatment of chronic wounds with critical colonization and/or biofilm recommends a process of mechanical washing with antiseptic solution (PVP-I), debridement, and disinfection with antiseptic (PVP-I)-soaked gauze [64]. It is hoped that widespread uptake and implementation of such processes within nursing homes will overcome some of the challenges associated with the use of other antiseptics, and improve healing outcomes for patients.

Focus area 3: oral care in nursing homes

The elderly population is markedly at risk of more dental problems, such as dental caries and periodontal issues, compared with younger individuals [111]. In our experience, once elderly individuals are admitted to a nursing home, the frequency of their dental appointments decreases. A 'three interlocking gears' theory has demonstrated that a lack of oral care in nursing homes may arise through complex interactions affecting caregivers' and residents' behaviours surrounding oral health [112]. Understanding these obstacles surrounding oral care in the elderly may prevent the consequences of poor oral health, improving the quality of life of residents [112].

In the nursing home population, poor oral health has been associated with poor overall health and psychological well-being, malnutrition, and mortality [113]. In a study of oral care in nursing home residents in Japan, those who had their teeth cleaned by toothbrushing and sometimes swabbing with PVP-I had lower occurrences of pneumonia and improvements in daily life [114]. Good oral hygiene of both natural dental tissue and prostheses is important for acceptable oral-health-related quality of life [115].

Poor oral care may lead to periodontitis: an infectious and inflammatory oral disease with an adverse impact on systemic health [116]. In susceptible individuals, dysbiosis of the periodontal microbiota can trigger a pathogenic state, causing oral disease [116]. The resulting tooth-associated biofilm may cause respiratory infections, due to the aspiration of bacteria [117]. As aspiration of bacteria is a major cause of pneumonia in nursing home residents [116], the pathogenic state of periodontitis is likely to increase this risk [117].

The oral cavity is also believed to play a role in SARS-CoV-2 transmission [118,119], and healthcare staff providing oral care to nursing home residents are at risk of viral transmission from residents this way [120]. In patients with COVID-19, peri-odontitis is associated with higher risk of intensive care unit admission, need for assisted ventilation, and death [121]. Hence, control of oral viral load and hand hygiene is necessary to reduce transmission between healthcare staff and residents, and to ameliorate the risk of morbidity and mortality associated with periodontitis.

Practical recommendations for oral care in nursing homes: oral hygiene

Periodontal disease can be treated with good oral hygiene: use of electric toothbrushes [122], interdental brushes [123], scaling and debridement, antiseptic-containing mouthwash, and cleaning of oral prostheses with antiseptics. In our experience, antiseptic mouthwash should be used at the beginning of dental treatments, after debridement, and, depending on the efficacy of mechanical cleaning, may be used during maintenance of oral health for both natural dental tissue and prostheses (Table I). Findings from treatment of intubated patients with antiseptic mouthwashes also suggest that antiseptics may have a limited effect if dental plaque is established and not debrided [124]. Therefore, debridement and subsequent antiseptic mouthwashing may prevent biofilm formation and aspiration of oral bacteria [124].

In nursing homes, post-prandial cleaning of residents' teeth by toothbrushing and weekly professional dental care (including swabbing with PVP-I when necessary) resulted in a significant reduction in pneumonia and death from pneumonia [114,125]. Wearing dentures during sleep has been shown to increase oral inflammation and microbial burden, and to double the risk of pneumonia in the very elderly [126], reinforcing the need to clean oral prostheses with antiseptic solution.

Role of antiseptics for oral health maintenance

Chlorhexidine gluconate is currently one of the most widely used antimicrobial agents in dental practice [127]; however, PVP-I may yield advantages for oral care in nursing homes [128]. CHG mouthwash is recommended as an adjunct strategy for early periodontitis and has demonstrated reduction of gingivitis in patients with mild gingival inflammation after four to six weeks of use [129]. PVP-I has been assessed in peri-odontitis management [128]: PVP-I oral rinsing, in addition to scaling and root planning, significantly enhanced the probing pocket depth reduction in patients with chronic periodontitis [130]. In patients with advanced destructive periodontitis, topical application of PVP-I improved gingival conditions when used in conjunction with mechanical debridement [131].

An ideal antiseptic for management of oral care in nursing homes should be effective against a broad spectrum of common oral pathogens without risk of resistance, should reduce the risk of periodontal disease, should leave dental tissue and prostheses unstained after use, and should not be inhibited by blood and/or pus (Table I) [128]; each of these attributes is addressed below.

Efficacy and resistance

PVP-I oral products have demonstrated efficacy against more clinically relevant oral pathogens than CHG mouthwash *in vitro* (Supplementary Table S2) [132]. In a clinical study, CHG oral rinse did not reduce incidence of aspiration pneumonia, suggesting lack of efficacy in reducing the periodontal reservoir of pathogenic bacteria [133]. Conversely, application of PVP-I to an artificial biofilm comprised of *Porphyromonas gingivalis* and *Fusobacterium nucleatum*, two periodontal pathogens, demonstrated suppression of these bacteria at concentrations used for daily oral rinses, indicating a clinical use for PVP-I in subgingival biofilm control [134]. Further data are available supporting the use of PVP-I as a component in a rinse with hydrogen peroxide to decrease levels of gingivitis-associated biofilms [135]. Although no microbial resistance to PVP-I has been reported to date [60], tolerance of multi-species oral biofilms to CHG has been observed [136]. In another study, after one oral rinse with CHG, oral biofilms presented with significantly higher resistance to CHG than in a control salivary microbiome [137].

Staining

Staining of dental tissue is frequent in individuals using CHG long term [138], and newer formulations require an anti-discolouration system to reduce staining [139]. Prolonged use of PVP-I mouthwash has not been shown to stain teeth, cause irritation, affect thyroid function, or cause a change in gustatory function [138,140,141].

Inhibition by organic materials

As previously discussed, CHG activity is reduced in the presence of organic matter compared with PVP-I activity [104,108—110,142]. Thus, PVP-I may be a more appropriate choice for use within oral care regimens for nursing home residents.

Oral care and viral transmission: lessons from the COVID-19 pandemic

Regular use of antiviral mouth rinses is recommended to decrease the SARS-CoV-2 viral load in droplets emitted by COVID-19 patients [119,120,127,143,144]. The use of PVP-I has been proposed as a pre-treatment preparation for all individuals requiring dental treatment during the COVID-19 pandemic [120].

PVP-I has superior virucidal activity compared with CHG [120,145,146]. There are limited data demonstrating the virucidal activity of CHG against coronaviruses, and some studies demonstrated that CHG is ineffective at reducing oral viral load and inactivating some coronavirus subtypes, including SARS-CoV-2 [118,146—149]. In a randomized controlled trial evaluating the efficacy of PVP-I, CHG, and cetylpyridinium chloride in reducing salivary SARS-CoV-2 viral load, cetylpyridinium chloride and PVP-I significantly decreased salivary load compared with water mouthwashing in patients with COVID-19 [144]. No significant decrease in salivary SARS-CoV-2 viral load was seen with CHG when compared with water mouthwashing [144]. When comparing PVP-I and hydrogen peroxide in the inactivation of salivary SARS-CoV-2, PVP-I oral rinse completely inactivated the virus at concentrations of 0.5%, 1.25%, and 1.5% after 15 and 30 s exposures [150]; at concentrations of 1.5% and 3.0%, hydrogen peroxide showed minimal virucidal activity after the same exposure times [150].

Focus area 3: summary and recommendations

Collectively, these data suggest that PVP-I fulfils the criteria of an ideal antiseptic for management of general oral health in nursing homes (Table I). PVP-I has demonstrated rapid in-vitro virucidal activity against SARS-CoV-2 as a gargle and mouthwash product [151,152] as well as an antiseptic solution, skin cleanser, and throat spray [152]. Hence, PVP-I may be valuable in nursing home protocols for control of oral viral load and hand hygiene [152].

Conclusion

Nursing homes are an important component of the health service for the elderly population. However, they are ideal environments for induction and transmission of infections. Antiseptics yield advantages versus antibiotics for infection management in nursing homes, especially in the management of MRSA decolonization and chronic wounds. Whereas many antiseptics have demonstrated efficacy in some areas of infection management in nursing homes, PVP-I appears to fulfil the characteristics of the ideal antiseptic for MRSA decolonization, chronic wound care, and oral care. PVP-I may also play an important role in controlling COVID-19 infections in nursing homes.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jhin.2022.09.020

Author contributions

All authors contributed to conceptualization and writing (reviewing and editing) the manuscript. All authors have read and approved the final version of the manuscript.

Conflict of interest statement

All authors have served as consultants for Viatris. L.G. has also received honoraria from, and is a Chair of, Wondzorg.net. J.R.S. has also received funding from GlaxoSmithKline for congress attendance.

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